Space Weather Technical Forecast

Issued on Wednesday, 17 November 2021 at 13:16 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Active Electron Fluence likely at times through Days 1-4 (17th-20th). Otherwise no significant activity expected.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was very low with three stable sunspots on the visible disc and no significant flare activity observed. AR2897 in the far northeast contains a fairly small, asymmetric spot. There is possible emergence of a number of trailer spots to the southeast of this, but for now an Hax/Alpha configuration is given to the region. AR2894 and AR2896 are simple, mature regions and appear stable at present. The former is soon to rotate over the sun's western limb, meanwhile AR2896 is located in the southeast quadrant. No Earth-directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar wind speeds have been elevated to strong through the period averaging around 600km/s. The peak was 660 km/s at 170551UTC. This is due to a connection with the High Speed Stream from negative Coronal Hole 19. The density has been average or slightly above average, reaching a peak of nearly 12 ppcc at 17/0117 UTC. The IMF has been mainly weak, but with a peak at moderate levels of just over 8nT at 17/0023 UTC. The north-south component, Bz, varied between +6 and -7nT. The phi angle was mostly negative (towards the Sun), indicative of the connection to Coronal Hole 19. Geomagnetic activity was mainly Quiet (Kp2) with an Active (Kp4) interval from 17/0001-0300 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured by GOES-16, remained at background levels. The high energy electron flux (greater than 2 MeV) was predominantly background, below 100 pfu. The associated 24-hour integrated fluence remained below the Active threshold (1e8 integrated pfu), on a steady trend, with 2.24e6 integrated pfu recorded at 16/2359 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be mainly Very Low, with a slight chance of C-class flares from the three sunspot regions on the visible disc.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs in the current forecast. Solar wind speeds are expected to remain elevated or strong through Day 1 (17th Nov) then declining through Days 2 to 4 (18th-20th) to background levels. Geomagnetic activity is expected to be Quiet or Unsettled on Day 1, with the chance of an isolated Active interval. Mainly Quiet activity is then forecast during Days 2-4, with a slight but decreasing chance of Unsettled periods.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to be at background levels. The high energy electron flux (greater than 2 MeV) is expected to rise to persistently moderate or high levels on Day 1 in response to the recent solar wind enhancement and likely remaining at similar levels for the remainder of the period. The

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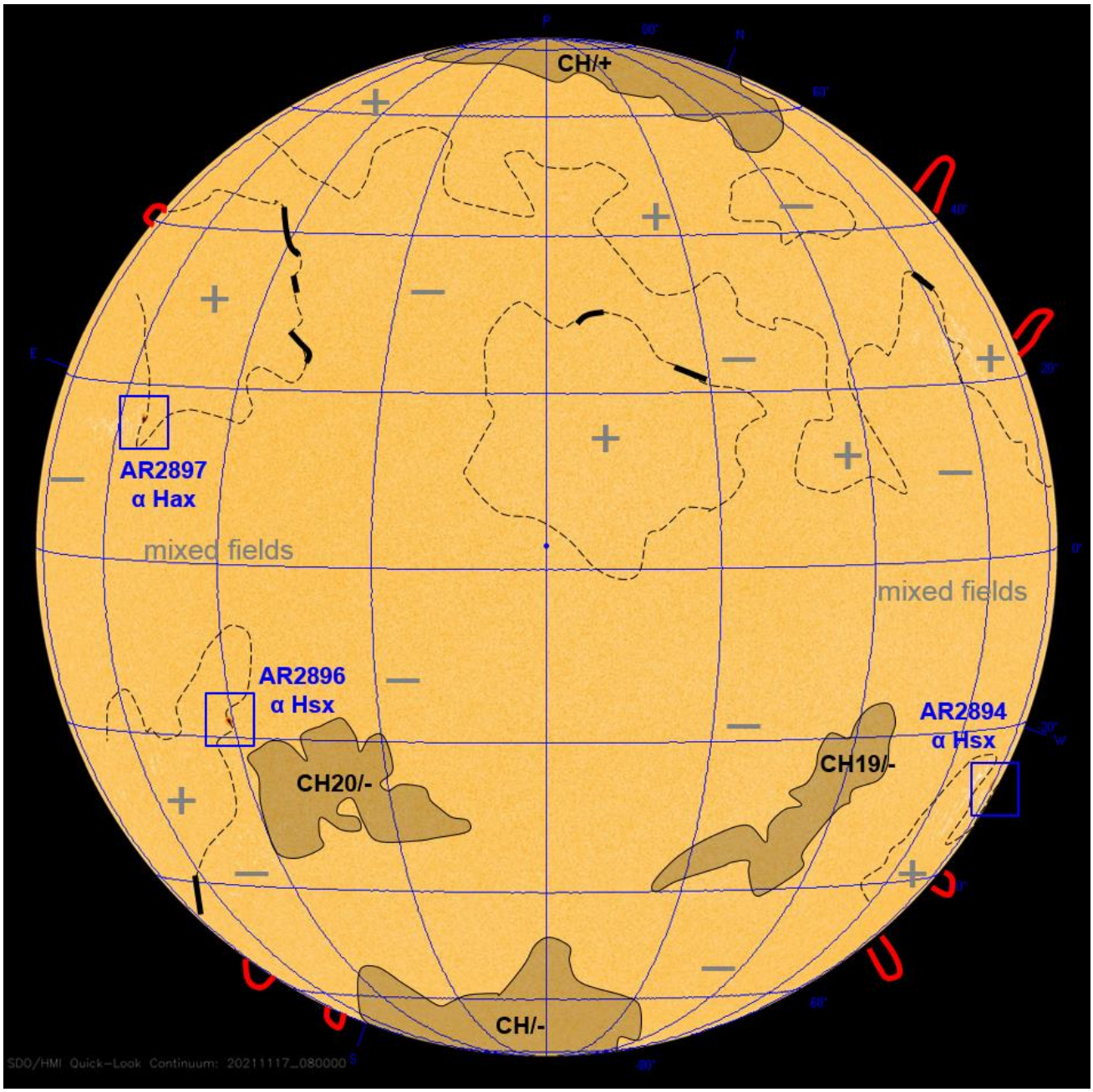
corresponding 24-hour electron fluence is expected to rise sharply in response during Day 1, probably increasing above the Active (1e8 integrated pfu) threshold either late on Day 1 or during Day 2.

Figure 1. Solar Analysis Valid 17/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Met Office Space Weather Technical Forecast

Geomagnetic Storms:

There are no Earth-directed CMEs currently in the forecast period.

Solar wind speeds are elevated or strong due to a connection to the high speed stream from Coronal Hole 19. The high speed stream is expected to continue at a similar level at first on Day 1 (17th) before beginning to ease later and into Day 2 (18th) before declining to background on Day 3 (19th).

Geomagnetic activity is expected to be Quiet or Unsettled on Day 1, with the chance of an isolated Active interval. Mainly Quiet activity is then forecast during Days 2-4, with a slight but decreasing chance of Unsettled periods.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections – Nil.

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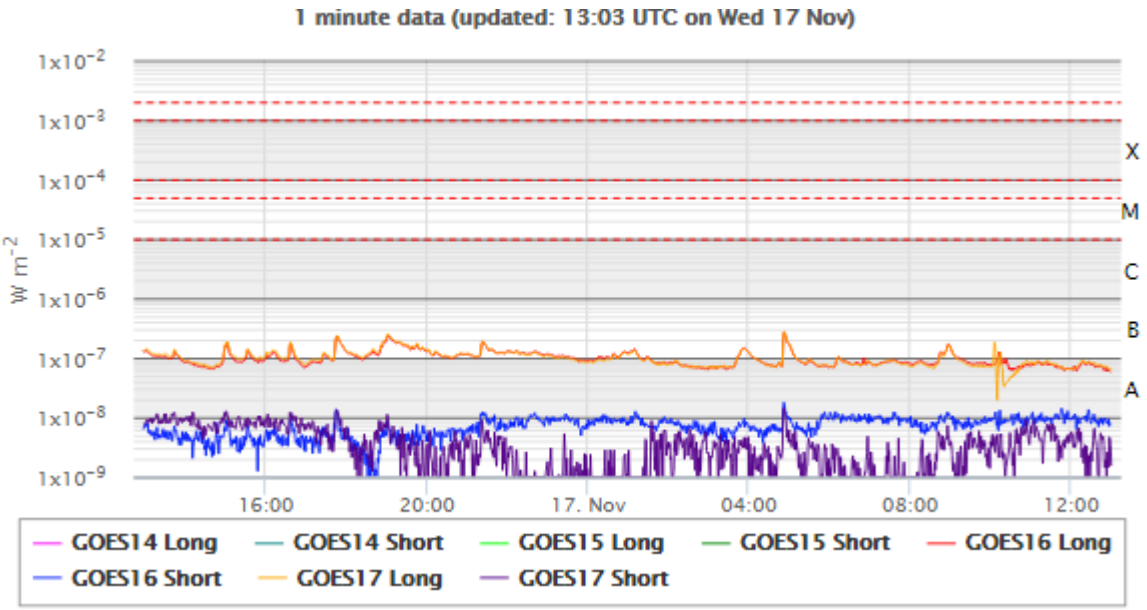
Radio Blackouts - X-Ray Flares:

There are currently three sunspot regions on the visible disc. AR2897 in the far northeast contains a fairly small, asymmetric spot. There is possible emergence of a number of trailer spots to the southeast of this, but for now an Hax/Alpha configuration is given to the region. AR2894 and AR2896 are simple, mature regions and appear stable at present. The former is soon to rotate over the sun's western limb, meanwhile AR2896 is located in the southeast quadrant.

Solar activity is expected to be at Very Low levels, with a slight chance for C-class flares. M-class flare probabilities are increased very slightly from the previous bulletin with the re-classification of AR2897.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	3	3	3	3
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 2: GOES-16/17 X-ray flux



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as measured by GOES-16, remained at background levels during the previous 24 hours, and is currently forecast to remain at this level through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) as measured by GOES-16 are currently near background levels, likely due to a mixture of radiation belt distortion due to the strong high speed stream, and a redistribution of electrons in the belts due to the recent geomagnetic enhancements. Later on Day 1 (17th) into Day 2 (18th) an increase in electron flux coinciding with the decrease in solar wind speeds and geomagnetic activity is expected, leading to a sustained period of moderate or high electron flux values.

Electron fluence is forecast to increase in line with the forecast increase in the electron flux. REFM forecasts that fluence will reach the Active (1e8 integrated pfu) either late on Day 1 or Day 2, with this trend broadly accepted. Perhaps easing back on Day 4 (20th).

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	50	80	80	50
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	5	5	1

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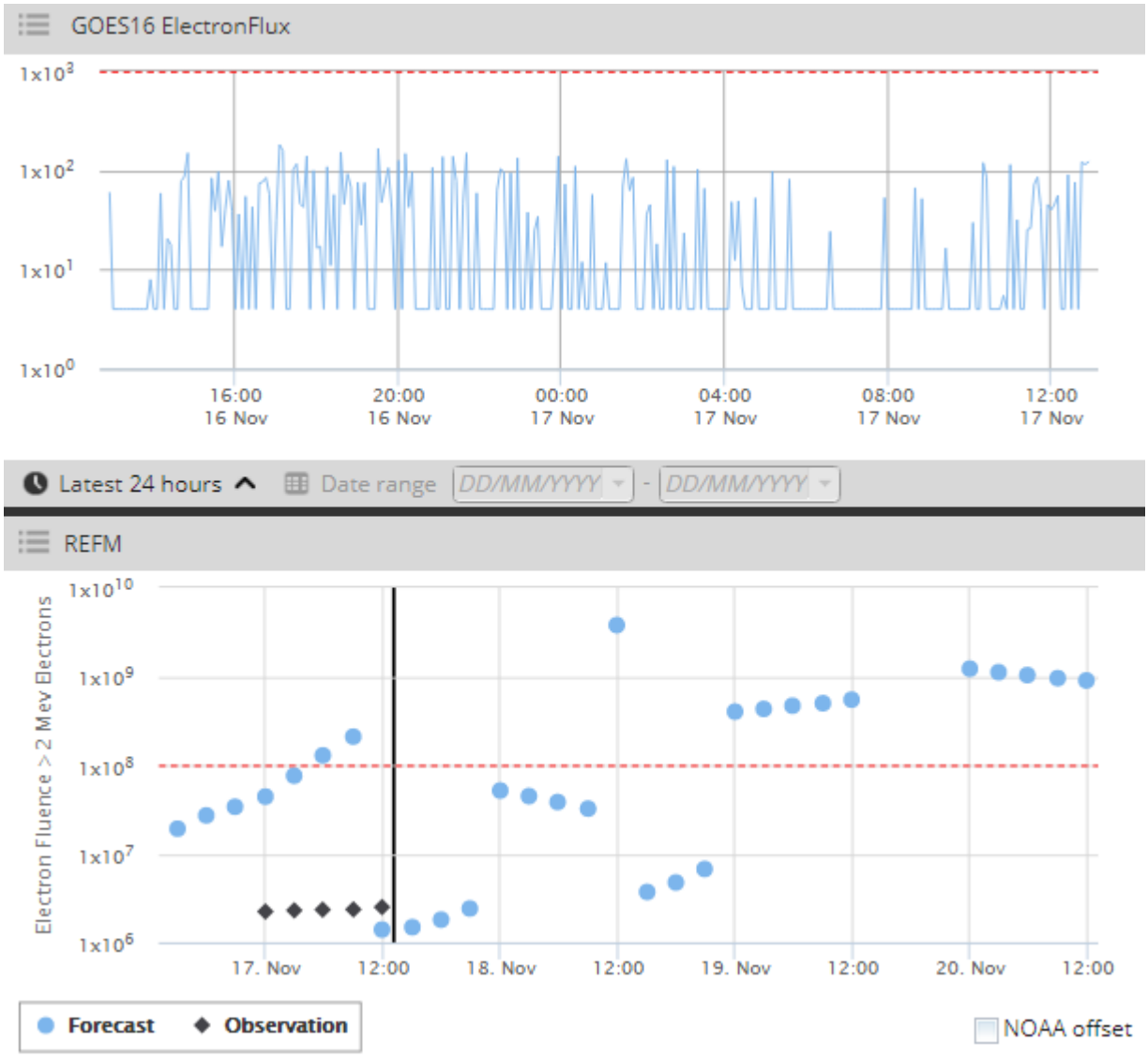
Figure 3: GOES-16 Electron Flux and REFM output. An REFM outage on the 16th is responsible for the fluctuating Fluence forecast, though the increase above Active levels is anticpated by the 17th.



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